Index of Contributors

Abrams, R. 50–55
Ackermann, R.F. 263–269
Altman, H. 91–98

Barkai, A. I. 120–123, 147–162
Baxter, L. 263–269
Belenky, G. L. 124–139
Blaine, J. D. 416–418
Bolwig, T. G. 140–146

Cowen, P. J. 163–171
Crovitz, H. F. 293–306
Crow, T. J. 12–29

Daniel, W. F. 293–306
Davidson, J. R. T. 270–281, 315–325
Decina, P. 56–64, 172–173, 249–262, 326–340, 398–410

Engel, J., Jr. 263–269
Essman, W. B. 99–104

Fink, M. 30–36
Flor-Henry, P. 389–397
Frankel, F. H. 411–415
Freeman, C. P. L. 341–352

Green, A. R. 105–119
Gustafson, L. 236–248

Hamilton, M. 5–11
Hartman, B. K. 224–231
Hitzemann, R. J. 124–139
Holaday, J. W. 124–139

Ingvar, M. 194–206, 207–223

Johnstone, E. C. 12–29
Jørgensen, O. S. 140–146

Kahn, E. M. 270–281
Kalinowsky, L. B. 1–4
Kanzler, M. 56–64, 398–410
Keegan, M. 91–98
Kellams, J. J. 37–49
Kellar, K. J. 76–90
Kendell, R. E. 341–352
Kerr, B. 56–64
Klapper, M. H. 37–49

Lerer, B. 91–98, 366–375
Long, J. B. 124–139

Malitz, S. ix, 56–64, 249–262, 326–340, 398–410, 416–418
McKinney, W. T. 65–69
Meldrum, B. S. 186–193
Miller, M. J. 37–49
Milstein, V. 37–49, 282–283

Neeley, P. 326–340

Ottosson, J.-O. 357–365

Portnoy, S. 326–340, 353–356, 398–410
Post, R. M. 376–388
Preskorn, S. H. 224–231
Prohovnik, I. 232–235, 249–262, 398–410
Putnam, F. 376–388

Risberg, J. 236–248
Rogers, H. J. 270–281, 315–325
Rosén, I. 236–248
Rubin, E. H. 224–231

Sackeim, H. A. ix, 56–64, 70–75, 249–262, 326–340, 398–410
Shapira, B. 366–375
Siesjö, B. K. 207–223
Silfverskiöld, P. 236–248
Small, I. F. 37–49
Small, J. G. 37–49
Squire, L. R. 307–314, 315–325
Stanley, M. 91–98
Steif, B. L. 326–340
Stockmeier, C. A. 76–90

Thompson, P. J. 284–292
Tortella, F. C. 124–139
Trimble, M. R. 284–292

Uhde, T. W. 376–388

Weaver, L. A., Jr. 174–185
Weiner, R. D. 270–281, 315–325
Weiss, S. R. B. 376–388
Wieloch, T. 207–223
Williams, R. W. 174–185

Subject Index

Abrams, Richard, 74
Accornero, F., 2, 4
Acetylcholine, 366, 370, 371, 414
Acidosis, tissue infarction and, 217–219
Acroagonine, 2
Action, mechanisms of, 357–417
  clinical perspectives on, 357–364
Affective systems, lateralized, ECT and, 389–395
Allylglycine, 188
Amitriptyline, 17, 81, 379
Amnesia
  ECT and, 308–311
  ECT-induced, animal model of, 91–97
Amphetamine, 166
Anesthesia, barbiturate, 3
Animal models of depression, ECT and, 65–68
Anticonvulsant, ECT as an, 376–385, 399–405
Antidepressant drugs, 3, 7, 12, 20, 72, 76–88, 120
Antidepressant efficacy of ECT, 398–407
Apomorphine, 166–169
Atropine, 58, 370
Attitudes, toward ECT, 3
  patients', 341–352
Autoradiographic studies of glucose utilization following seizures, 263–267

"Balance" hypotheses, 369–371
Barbiturate anesthesia, 3
Barkai, Amiram I., 172
Behavioral effects of electroconvulsive shock, 126–128
Behavioral sequelae of spontaneous seizures, 284–291
Bennett, A. E., 3, 4
Benzodiazepine, 22
Bicuculline, 107, 108, 188, 199
Bilateral ECT
  effects compared with those of unilateral ECT, 50–53, 56–63, 73–74, 412
  efficacy of, 56–63
Bini, L., 1–3, 4, 416
Biochemical effects of ECT, 120–123
Biochemistry, 76–173
  GABA, 105–117
Bolwig, T. G., 172
Brain, rat, effects of electroconvulsive shock on beta-adrenergic and serotin-2 receptors in, 76–88
Brain damage, epileptic, cellular and molecular events underlying, 207–219
Brain electrical activity, effects of ECT on, 270–280
Brief Psychiatric Rating Scale, 317

Calcium, cell death and, 215–217
California F scale, 8
Camphor in oil, induction of seizures with, 1
Carbamazepine, 37, 148–161, 376–385, 412, 413
Catecholamine hypothesis, 366–368
Central adrenergic system, role in regulation of cerebromicrocirculation, 224–229
Cerebral blood flow, ECT and, 202–203, 236–247, 249–260
Cerebral monoaminergic systems, interactions of drugs and electroshock treatment on, 147–161
Cerebromicrocirculation, role of central adrenergic system in regulation of, 224–229
Cerletti, U., 1–3, 4, 416
Clonidine, 164–166
Cognitive impairment, role of seizures in, 288
Cognitive side effects, ECT and, 284–356
Compazine, 3
Consent to ECT, 349–351
Contraindications for ECT, 8
Controlled trials, 12–37
Convulsive therapy
  criticism of, 5
  history of, 1–4
  opposition to, 2, 3
  pharmacological, 3
  See also Electroconvulsive therapy
Cortisol, 30, 34
Cowen, P. J., 172
Crow, Timothy J., 12–29, 70
Curare, 3, 5

Delirium, ECT and, 3
Depression
  animal models of, ECT and, 65–68
  ECT and, 3, 5–7
  endogenous, unilateral ECT and, 50–53
  neural excitability and, 406
Desipramine, 83, 85, 120, 369
Dexamethasone suppression test (DST), 30–34

Diazepam, 190, 377, 379
Diethylether, hexalfuorinated, 3
Diisopropylfluorophosphate, 370
Disorientation during ECT, 293–304
Dopaminergic synapse, effects of electroshock treatment and haloperidol, 151–153
Dosage, units of, 406–407
Dose-response interactions with modality, 56–63
Drugs
  antidepressant, 3, 7, 12, 20, 72, 76–88, 120
  interactions of electroshock treatment and, on cerebral monaminergic systems, 147–161
Dynorphin, 127

ECT, *see* Electroconvulsive therapy
Effects, acute and late, of ECT, 236–247
Efficacy of ECT, 5–75
  antidepressant, 398–407
Electroconvulsive shock
  anticonvulsant effects of, 376–385
  autonomic effects of, 132–134
  behavioral effects of, 126–128
  effect on serotonin activity, 99–103
  effects on beta-adrenergic receptors in brain, 76–80, 83
  effects on serotonin receptors, 80–85
  electroencephalographic responses to, 128–131
  neurophathological consequences of, 186–191
Electroconvulsive therapy (ECT)
  as an anticonvulsant, 376–368, 399–405
  attitudes toward, 3
    patients', 341–352
  biochemistry of, 76–173
  consent to, 349–351
  contraindications, 8
  criticism of, 56
  disorientation during, 293–304
  effects of, acute and late, 236–247
  effects upon brain electrical activity, 270–280
  efficacy of, 5–75
    antidepressant, 398–407
  electrophysiology of, 270–280
  history of, 1–4
  indications for, 5–7
  introduction of, 1, 2
  lateralized affective systems and, 389–395
  low-dosage, cognitive consequences of, 326–329
  mechanisms of action, 357–417
  memory functions and, 303–313, 318–323
  neurochemical effects of, 366–372
  neuroendocrine responses as a probe into the mechanisms of action of, 163–169
  neuroendrinological effects of, 76–173
  neurophysiological effects of, 174–283
  neuropsychological effects of, 284–356
  opioids and, 136–137
  opposition to, 2, 3, 5
  patients experiences of, 341–352
  sham, 70–71, 411, 416
  stimulus parameters and, 174–185
  synaptic proteins and, 140–144
  unilateral, compared with bilateral, 50–53, 56–63, 73–74, 412
Electroencephalogram, effects of ECT on the, 236, 247
Electroencephalographic effects of electroconvulsive shock, 128–131
Electrophysiology of ECT, 270–280
Electroshock treatment, interactions of drugs and, on cerebral monoaminergic systems, 147–161
Epileptic brain damage, cellular and molecular events underlying, 207–219
Epinephrine, 30
Essman, Walter B., 120, 121
Experiences, patients', of ECT, 341–352

Fink, Max, 1, 57, 105
Flor-Henry, Pierre, 406, 412
Flurothyl, 105, 194–195, 199
Fractures, 3
Frankel, Fred H., 417
Freeman, C. P. L., 356
Funkenstein test, 8, 30

GABA biochemistry, 105–117, 414
Glucose utilization following electroconvulsive seizures, 263–267
Green, A. Richard, 121–122

Haloperidol, 148–161
Hamilton Depression Rating Scale, 317
Hexafluorodiethylether, 194–195
Hexobarbital, 16
History of convulsive therapy, 1–4
Hobson scale, 9
Holaday, John W., 172
Hypertension, ECT and, 8

Ibotenic acid, 199
Imipramine, 12, 15, 17, 85, 120, 148–161, 379
Indications for ECT, 5–7
Indoklon, 3, 389
Indoleamine hypothesis, 368–370
Ingvar, Martin, 234
Insulin coma therapy, 2
International League Against Epilepsy, 284, 285
Iprindole, 81, 120, 379

Jablonski, A., 1, 4
Jauregg, Wagner von, 4
Johnstone, Eve C., 70
Jørgensen, O. S., 172

Kahn, E. Michael, 270
Kainate, 188
Kainic acid, 187, 188, 199
Kellar, Kenneth J., 120
Kindling, 403–404
  effect of electroconvulsive shock on, 379–380
Krantz, J. C., Jr., 3, 4

Lateralized affective systems, ECT and, 389–395
Lerer, Bernard, 120, 121, 414
Lidocaine, 17, 187
Lithium, 7, 37, 38–48, 148–161, 173, 371, 383, 384
Lithium carbonate, 385
Long-term therapeutic effects of ECT, 71–72
Lorazepam, 58
Low-dosage ECT, cognitive consequences of, 326–339

Maltz, Sidney, 74, 406, 412, 413, 414
Mania, treatment for, 7, 37–48
McKinney, William T., 72
Mechanisms of action, 357–417
  clinical perspectives on, 357–364
Meduna, L. J., 1–34, 416
Melancholia, unspecific ECT effects in, 359–360
Meldrum, Brian S., 234
Memory function, ECT and, 307–313, 318–323
Mendels scale, 9
Metabolic rate during seizures, 195–202
Metenkephalin, 414
Methacholine, 30
Methohexital, 58
Methoxypyridoxine, 188
Metrazol, 1, 3, 389
Mianserin, 120, 379
Moniz, E., 2, 4
Monoamine metabolites, interaction of electroshock treatment and drugs on cerebral fluid levels of, 148–151
Mood stabilization, neurochemical mechanisms of, 366–372
Morihisa, John, 402
Morphine, 126–127, 131, 133–136
Müller, Max, 2
Muscle relaxants, 3, 5, 8, 58

Naloxone, 126–137
Neostigmine, 370
Neural excitability, depression and, 406
Neurochemical effects of ECT, 366–372
Neurochemical events during seizures, 207–213
Neuroendocrine predictors of ECT outcome, 30–34
Neuroendocrine responses, 163–169
Neuroendocrinological effects of ECT, 120–123
Neuroleptics, 7
Neurometabolic rates, 402–403
Neurophysiological effects of ECT, 174–283, 412–414
Neuropsychological effects of ECT, 284–356
Newcastle scale, 9
Noradrenaline-serotonin interactions, 369–370
Nortriptyline, 379
Nyiro, J., 1, 4

Oliver, W., 1, 4
Opioids, endogenous, 124–137, 371
  anticonvulsant effects of, 131
Opposition to ECT, 2, 3, 5
Ottosson, Jan-Otto, 412, 413, 416
Outcome, ECT, neuroendocrine predictors, 30–34

Patients' experiences of, and attitudes toward ECT, 341–352
Pentobarbital, 83
Pentothal, 16
Pentylenetetrazol, 1, 188, 199
Permissive hypothesis, 369
Pharmacological convulsive therapy, 3
Phenelzine, 12
Physiological tests, ECT and, 8–9
Physostigmine, 370
Picrotoxin, 188
Pilocarpine, 187, 188, 370
Positron emission tomography, 263–267
Post, Robert M., 412, 413, 414
Prediction of response to ECT, 8–10, 25
Predictive scales, 9–10
Progabide, 117, 383, 405
Prohovnik, Isak, 282, 398, 402
Prolactin response to ECT, 33, 53
Prostigmine, 3
Protein, synaptic, ECT effects on, 140–144
Psychological tests, ECT and, 8
Psychopharmachotherapy, 8

Quinalbarbitone, 16
Quipazine, 107, 369

Rat brain, effects of electroconvulsive shock on beta-adrenergic and serotonin-2 receptors in, 76–88
Receptors, 414
Reserpine, 79–80, 120
Response to ECT, prediction of, 8–10, 25
Rorschach test, 8
Rubin, Eugene H., 233–234

Sackeim, Harold A., 353, 354, 356, 412, 413
Sakel, M., 2, 4
Schaffer, Karl, 2
Schizophrenia, 2
  convulsive therapy and, 3, 5, 7
  seizures and, 1
  trials of ECT in, 25–26
Seizure duration, 401–402, 413
Seizure threshold, 399–400, 413
  following a convulsion, 107
  measurement of, 105–106
Seizures
  cerebral blood flow during, 202–203
  chemically induced, in experimental animals, 187
  classification of, 284, 285
  generalized, 188, 284, 285
  limbic, 188–189
  metabolic rate during, 195–202
  partial, 284, 285
  positron emission tomography and autoradiographic studies of glucose utilization following, 263–267
  role of, in cognitive impairment, 288
  schizophrenia and, 1
  short-lasting, neurochemical events during, 213
  spontaneous, 403–404
    neuropsychological and behavioral sequelae of, 284–291
  sustained, neurochemical events during, 207–213
Serotonergic synapse, 153–156
Serotonin
  effect of electroconvulsive shock on, 99–103
  effects on norepinephrine receptor regulation, 85–87
Serotonin-noradrenaline interactions, 369–370
Sham ECT, 70–71, 411, 416
Shock, electroconvulsive, *see* Electroconvulsive shock
Side effects
  cognitive, 284–356
  patients' remembrance of, 345–347
Siesjö, Bo K., 234
Silfverskiöld, Peter, 282, 402
"Single amine" hypotheses, 369
Sodium valproate, 405
Somatostatin, 384
Squire, Larry R., 355
Squire's Subjective Memory Questionnaire, 318
Stanley, Michael, 91
Status epilepticus, experimental,
  histological damage due to, 194–195
Stimulus parameters
  cognitive side effects and, 315–325
  ECT and, 174–185
Stimulus waveforms, 407, 412
Strychnine, 107, 187
Succinyl choline, 3, 58
Synaptic proteins, ECT effects on, 140–144

Tests, ECT and, 8–9
  physiological, 8–9
  psychological, 8
Therapeutic effects of ECT, long-term, 71–72
Therapy, *see* Convulsive therapy; Electroconvulsive therapy; Insulin coma therapy; Psychopharmacotherapy
Thiopental, 16, 17, 58
Tranylocypromine, 81
Trials, controlled, 12–27
2-deoxyglocose (2DG) method, 263–267

Unilateral ECT
  effects compared with those of bilateral ECT, 50–53, 56–63, 73–74, 412
  efficacy of, 56–63
  treatment of endogenous depression, 50–53

Valproic acid, 377, 382, 383
Von Meduna, *see* Meduna, L. J.

Weaver, Lelon A., Jr., 232–233
Weiner, Richard D., 353, 356
Williams, Ronald W., 232–233

Zung Self-Rating Depression Scale, 317

ANNALS OF THE NEW YORK ACADEMY OF SCIENCES

Volume 462

March 14, 1986

ELECTROCONVULSIVE THERAPY[a]

Clinical and Basic Research Issues

Editors and Conference Organizers

SIDNEY MALITZ and HAROLD A. SACKEIM

CONTENTS

Preface. *By* HAROLD A. SACKEIM and SIDNEY MALITZ ix

History of Convulsive Therapy. *By* LOTHAR B. KALINOWSKY 1

Part I. Efficacy

Electroconvulsive Therapy: Indications and Contraindications. *By* MAX HAMILTON 5

Controlled Trials of Electroconvulsive Therapy. *By* TIMOTHY J. CROW and EVE C. JOHNSTONE 12

Neuroendocrine Predictors of Electroconvulsive Therapy Outcome: Dexamethasone Suppression Test and Prolactin. *By* MAX FINK 30

Electroconvulsive Therapy in the Treatment of Manic Episodes. *By* JOYCE G. SMALL, VICTOR MILSTEIN, MARIETTA H. KLAPPER, JEFFREY J. KELLAMS, MARVIN J. MILLER, and IVER F. SMALL 37

Is Unilateral Electroconvulsive Therapy Really the Treatment of Choice in Endogenous Depression? *By* RICHARD ABRAMS 50

The Efficacy of Electroconvulsive Therapy: Dose-Response Interactions with Modality. *By* SIDNEY MALITZ, HAROLD A. SACKEIM, PAOLO DECINA, MAUREEN KANZLER, and BARBARA KERR 56

Electroconvulsive Therapy and Animal Models of Depression. *By* WILLIAM T. MCKINNEY 65

The Efficacy of Electroconvulsive Therapy: Discussion of Part I. *By* HAROLD A. SACKEIM 70

Part II. Biochemical and Neuroendocrinological Effects 1

Effects of Electroconvulsive Shock and Serotonin Axon Lesions on Beta-Adrenergic and Serotonin-2 Receptors in Rat Brain. *By* KENNETH J. KELLAR and CRAIG A. STOCKMEIER 76

[a]This volume is the result of a conference entitled Elec'roconvulsive Therapy: Clinical and Basic Research Issues held from January 16 to January 18, 1985 in New York, N.Y., sponsored by The New York Academy of Sciences and the National Institute of Mental Health.

An Animal Model of Electroconvulsive-Therapy-Induced Amnesia: Possible Neurochemical Correlates. *By* BERNARD LERER, MICHAEL STANLEY, HARVEY ALTMAN, and MICHAEL KEEGAN 91

Effect of Electroconvulsive Shock on Serotonin Activity. *By* WALTER B. ESSMAN 99

Changes in γ-Aminobutyric Acid Biochemistry and Seizure Threshold. *By* A. RICHARD GREEN 105

Biochemical and Neuroendocrinological Effects of Electroconvulsive Therapy: Discussion of Part II. *By* AMIRAM I. BARKAI 120

Part III: Biochemical and Neuroendocrinological Effects 2

Endogenous Opioids and Their Receptors: Evidence for Involvement in the Postictal Effects of Electroconvulsive Shock. *By* JOHN W. HOLADAY, FRANK C. TORTELLA, JOSEPH B. LONG, G. L. BELENKY, and ROBERT J. HITZEMANN 124

Electroconvulsive Therapy Effects on Synaptic Proteins. *By* T. G. BOLWIG and O. S. JØRGENSEN 140

Interactions of Drugs and Electroshock Treatment on Cerebral Monoaminergic Systems. *By* AMIRAM I. BARKAI 147

Neuroendocrine Responses as a Probe into the Mechanisms of Action of Electroconvulsive Therapy. *By* P. J. COWEN 163

The Biochemistry of Electroconvulsive Therapy: Discussion of Part III. *By* PAOLO DECINA 172

Part IV. Neurophysiological Effects 1

Stimulus Parameters and Electroconvulsive Therapy. *By* LELON A. WEAVER, JR. and RONALD W. WILLIAMS 174

Neuropathological Consequences of Chemically and Electrically Induced Seizures. *By* BRIAN S. MELDRUM 186

Cerebral Blood Flow and Metabolic Rate during Seizures: Relationship to Epileptic Brain Damage. *By* MARTIN INGVAR 194

Cellular and Molecular Events Underlying Epileptic Brain Damage. *By* BO K. SIESJÖ, MARTIN INGVAR, and TADEUSZ WIELOCH 207

The Role of the Central Adrenergic System in the Regulation of the Cerebromicrocirculation: Basic and Clinical Implications. *By* EUGENE H. RUBIN, SHELDON H. PRESKORN, and BOYD K. HARTMAN 224

Neurophysiology of Electroconvulsive Therapy: Discussion of Part IV. *By* ISAK PROHOVNIK 232

Part V. Neurophysiological Effects 2

Acute and Late Effects of Electroconvulsive Therapy: Clinical Outcome, Regional Cerebral Blood Flow, and Electroencephalogram. *By* PETER SILFVERSKIÖLD, LARS GUSTAFSON, JARL RISBERG, and INGMAR ROSÉN 236

Acute Reductions of Regional Cerebral Blood Flow following Electroconvulsive Therapy: Interactions with Modality and Time. *By* ISAK PROHOVNIK, HAROLD A. SACKEIM, PAOLO DECINA, and SIDNEY MALITZ 249

Positron Emission Tomography and Autoradiographic Studies of Glucose Utilization following Electroconvulsive Seizures in Humans and Rats. *By* ROBERT F. ACKERMANN, JEROME ENGEL, JR., and LEWIS BAXTER 263

Effects of Electroconvulsive Therapy upon Brain Electrical Activity. *By* RICHARD D. WEINER, HELEN J. ROGERS, JONATHAN R. T. DAVIDSON, and E. MICHAEL KAHN 270

Neurophysiological Effects: Discussion of Part V. *By* VICTOR MILSTEIN 282

Part VI. Neuropsychological Effects

Neuropsychological and Behavioral Sequelae of Spontaneous Seizures. *By* MICHAEL R. TRIMBLE and PAMELA J. THOMPSON 284

Disorientation during Electroconvulsive Therapy: Technical, Theoretical, and Neuropsychological Issues. *By* WALTER F. DANIEL and HERBERT F. CROVITZ 293

Memory Functions as Affected by Electroconvulsive Therapy. *By* LARRY R. SQUIRE 307

Effects of Stimulus Parameters on Cognitive Side Effects. *By* RICHARD D. WEINER, HELEN J. ROGERS, JONATHAN R. T. DAVIDSON, and LARRY R. SQUIRE 315

Cognitive Consequences of Low-Dosage Electroconvulsive Therapy. *By* HAROLD A. SACKEIM, STEPHANIE PORTNOY, PRISCILLA NEELEY, BARBARA L. STEIF, PAOLO DECINA, and SIDNEY MALITZ 326

Patients' Experiences of and Attitudes to Electroconvulsive Therapy. *By* C. P. L. FREEMAN and R. E. KENDELL 341

The Cognitive Side Effects of Electroconvulsive Therapy: Discussion of Part VI. *By* STEPHANIE PORTNOY 353

Part VII. Mechanisms of Action

Clinical Perspectives on Mechanism of Action. *By* JAN-OTTO OTTOSSON 357

Neurochemical Mechanisms of Mood Stabilization: Focus on Electroconvulsive Therapy. *By* BERNARD LERER and BARUCH SHAPIRA 366

Electroconvulsive Therapy as an Anticonvulsant: Implications for Its Mechanism of Action in Affective Illness. *By* ROBERT M. POST, FRANK PUTNAM, THOMAS W. UHDE, and SUSAN R. B. WEISS 376

Electroconvulsive Therapy and Lateralized Affective Systems. *By* PIERRE FLOR-HENRY 389

Dosage, Seizure Threshold, and the Antidepressant Efficacy of Electroconvulsive Therapy. *By* HAROLD A. SACKEIM, PAOLO DECINA, ISAK PROHOVNIK, STEPHANIE PORTNOY, MAUREEN KANZLER, and SIDNEY MALITZ 398

What Have We Learned? *By* FRED H. FRANKEL 411

Mechanisms of Action: Discussion of Part VII. *By* JACK D. BLAINE and SIDNEY MALITZ 416